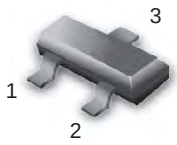
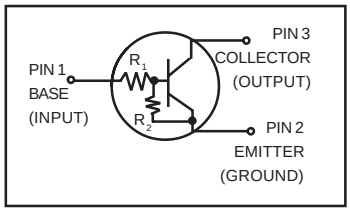
PNP Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space. The device is housed in the SOT-23 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SOT-23 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.
- Available in 8 mm embossed tape and reel. Use the Device Number to order the 7 inch/3000 unit reel. Replace “T1” with “T3” in the Device Number to order the 13 inch/10,000 unit reel.
- We declare that the material of product compliance with RoHS requirements and Halogen Free.
- S- Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.



SOT-23



MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Collector Current	I_C	100	mA

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation T_A = 25°C Derate above 25°C	P_D	246 (Note 1.) 400 (Note 2.) 1.5 (Note 1.) 2.0 (Note 2.)	mW °C/W
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	508 (Note 1.) 311 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	$R_{\theta JL}$	174 (Note 1.) 208 (Note 2.)	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	–55 to +150	°C

1. FR–4 @ Minimum Pad
2. FR–4 @ 1.0 x 1.0 inch Pad

DEVICE MARKING AND RESISTOR VALUES

Device	Package	Marking	R1 (K)	R2 (K)	Vin (V)	Shipping
S-MUN2110LT1G (Note 3.) S-MUN2110LT3G	SOT-23	A6O	47	∞	--	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2111LT1G S-MUN2111LT3G	SOT-23	A6A	10	10	-10~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2112LT1G S-MUN2112LT3G	SOT-23	A6B	22	22	-10~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2113LT1G S-MUN2113LT3G	SOT-23	A6C	47	47	-10~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2114LT1G S-MUN2114LT3G	SOT-23	A6D	10	47	-6~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2115LT1G S-MUN2115LT3G	SOT-23	A6E	10	∞	-6~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2116LT1G S-MUN2116LT3G	SOT-23	A6F	4.7	∞	-6~+30	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2130LT1G (Note 3.) S-MUN2130LT3G	SOT-23	A6G	1.0	1.0	-10~+10	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2131LT1G S-MUN2131LT3G	SOT-23	A6H	2.2	2.2	-10~+12	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2132LT1G S-MUN2132LT3G	SOT-23	A6J	4.7	4.7	-10~+30	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2133LT1G S-MUN2133LT3G	SOT-23	A6K	4.7	47	-5~+30	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2134LT1G (Note 3.) S-MUN2134LT3G	SOT-23	A6L	22	47	-8~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2136LT1G S-MUN2136LT3G	SOT-23	A6N	100	100	-10~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2137LT1G S-MUN2137LT3G	SOT-23	A6P	47	22	-10~+40	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2138LT1G (Note 3.) S-MUN2138LT3G	SOT-23	A6R	2.2	∞	-6~+12	3000/Tape & Reel 10,000/Tape & Reel
S-MUN2140LT1G (Note 3.) S-MUN2140LT3G	SOT-23	A6T	47	∞	-6~+40	3000/Tape & Reel 10,000/Tape & Reel

3. New devices. Updated curves to follow in subsequent data sheets.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Base Cutoff Current (V_{CB} = 50 V, I_E = 0)		I_{CBO}	–	–	100	nA
Collector-Emitter Cutoff Current (V_{CE} = 50 V, I_B = 0)		I_{CEO}	–	–	500	nA
Emitter-Base Cutoff Current (V_{EB} = 6.0 V, I_C = 0)	S-MUN2110LT1G	I_{EBO}	–	–	0.1	mA
	S-MUN2111LT1G		–	–	0.5	
	S-MUN2112LT1G		–	–	0.2	
	S-MUN2113LT1G		–	–	0.1	
	S-MUN2114LT1G		–	–	0.2	
	S-MUN2115LT1G		–	–	0.9	
	S-MUN2116LT1G		–	–	1.9	
	S-MUN2130LT1G		–	–	4.3	
	S-MUN2131LT1G		–	–	2.3	
	S-MUN2132LT1G		–	–	1.5	
	S-MUN2133LT1G		–	–	0.18	
	S-MUN2134LT1G		–	–	0.13	
	S-MUN2136LT1G		–	–	0.05	
	S-MUN2137LT1G		–	–	0.13	
	S-MUN2138LT1G		–	–	4.0	
	S-MUN2140LT1G		–	–	0.2	
Collector-Base Breakdown Voltage (I_C = 10 μA, I_E = 0)		$V_{(BR)CBO}$	50	–	–	V
Collector-Emitter Breakdown Voltage (Note 4.) (I_C = 2.0 mA, I_B = 0)		$V_{(BR)CEO}$	50	–	–	V

4. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.)						
DC Current Gain (V_{CE} = 10 V, I_C = 5.0 mA)	S-MUN2110LT1G	h_{FE}	80	140	–	
	S-MUN2111LT1G		35	60	–	
	S-MUN2112LT1G		60	100	–	
	S-MUN2113LT1G		80	140	–	
	S-MUN2114LT1G		80	140	–	
	S-MUN2115LT1G		160	250	–	
	S-MUN2116LT1G		160	250	–	
	S-MUN2130LT1G		3.0	5.0	–	
	S-MUN2131LT1G		8.0	15	–	
	S-MUN2132LT1G		15	27	–	
	S-MUN2133LT1G		80	140	–	
	S-MUN2134LT1G		80	130	–	
	S-MUN2136LT1G		80	150	–	
	S-MUN2137LT1G		80	140	–	
	S-MUN2138LT1G		160	350	–	
	S-MUN2140LT1G		120	250	–	
Collector-Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA) (I_C = 10 mA, I_B = 5 mA) S-MUN2130LT1G/S-MUN2131LT1G (I_C = 10 mA, I_B = 1 mA) S-MUN2115LT1G/S-MUN2116LT1G/ S-MUN2132LT1G/S-MUN2133LT1G/ S-MUN2134LT1G/S-MUN2138LTG/S-MUN2140LT1G		$V_{CE(sat)}$	–	–	0.25	V

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.)						
Output Voltage (on)		V_{OL}				V
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	S-MUN2110LT1G		–	–	0.2	
	S-MUN2114LT1G		–	–	0.2	
	S-MUN2111LT1G		–	–	0.2	
	S-MUN2112LT1G		–	–	0.2	
	S-MUN2114LT1G		–	–	0.2	
	S-MUN2115LT1G		–	–	0.2	
	S-MUN2116LT1G		–	–	0.2	
	S-MUN2130LT1G		–	–	0.2	
	S-MUN2131LT1G		–	–	0.2	
	S-MUN2132LT1G		–	–	0.2	
	S-MUN2133LT1G		–	–	0.2	
	S-MUN2134LT1G		–	–	0.2	
	S-MUN2138LT1G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	S-MUN2113LT1G		–	–	0.2	
	S-MUN2140LT1G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	S-MUN2136LT1G		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	S-MUN2137LT1G		–	–	0.2	
Output Voltage (off)		V_{OH}	4.9	–	–	V
(V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ)						
(V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	S-MUN2115LT1G					
	S-MUN2116LT1G					
	S-MUN2131LT1G					
	S-MUN2132LT1G					
	S-MUN2138LT1G					
	S-MUN2140LT1G					
(V_{CC} = 5.0 V, V_B = 0.050 V, R_L = 1.0 kΩ)	S-MUN2130LT1G					
Input Resistor	S-MUN2110LT1G	R_1	32.9	47	61.1	kΩ
	S-MUN2111LT1G		7.0	10	13	
	S-MUN2112LT1G		15.4	22	28.6	
	S-MUN2113LT1G		32.9	47	61.1	
	S-MUN2114LT1G		7.0	10	13	
	S-MUN2115LT1G		7.0	10	13	
	S-MUN2116LT1G		3.3	4.7	6.1	
	S-MUN2130LT1G		0.7	1.0	1.3	
	S-MUN2131LT1G		1.5	2.2	2.9	
	S-MUN2132LT1G		3.3	4.7	6.1	
	S-MUN2133LT1G		3.3	4.7	6.1	
	S-MUN2134LT1G		15.4	22	28.6	
	S-MUN2136LT1G		70	100	130	
	S-MUN2137LT1G		32.9	47	61.1	
	S-MUN2138LT1G		1.54	2.2	2.86	
	S-MUN2140LT1G		32.9	47	61.1	
Resistor Ratio	S-MUN2111LT1G/S-MUN2112LT1G/ S-MUN2113LT1G/S-MUN2136LT1G/ S-MUN2130LT1G/S-MUN2131LT1G/ S-MUN2132LT1G	R_1/R_2	0.8	1.0	1.2	
	S-MUN2114LT1G		0.17	0.21	0.25	
	S-MUN2115LT1G/S-MUN2116LT1G/S-MUN2110LT1G/S-MUM2138LT1G/S-MUN2140LT1G		–	–	–	
	S-MUN2133LT1G		0.055	0.1	0.185	
	S-MUN2137LT1G		1.7	2.1	2.6	

5. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2111LT1G

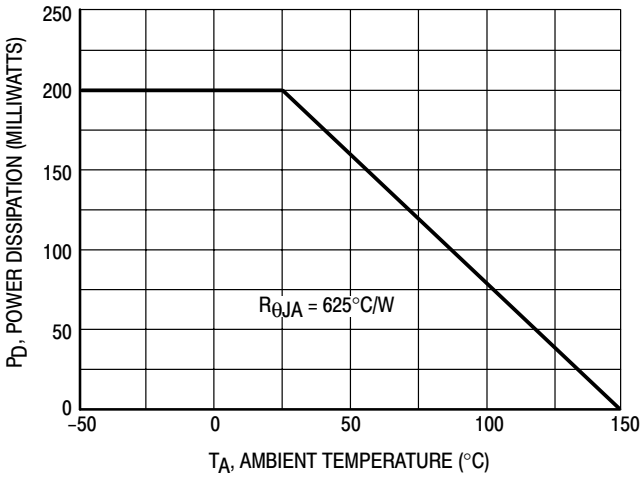


Figure 1. Derating Curve

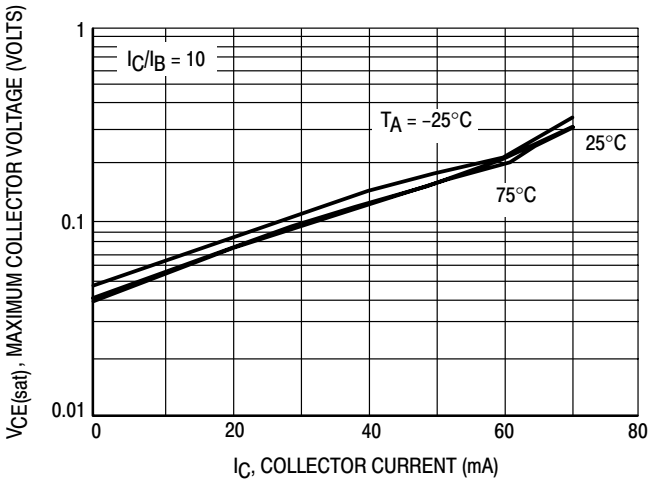


Figure 2. $V_{CE(sat)}$ versus I_C

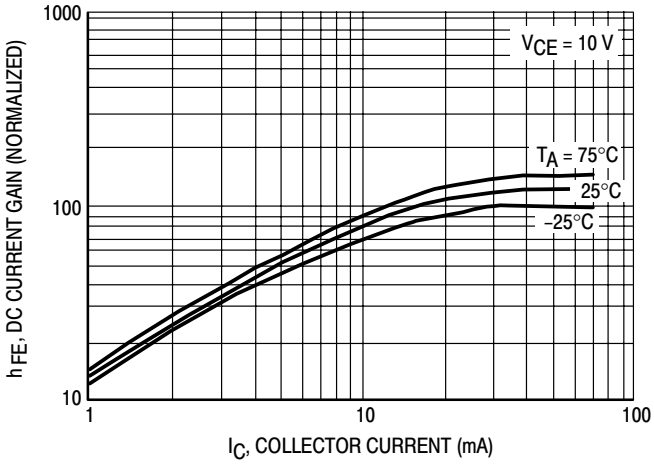


Figure 3. DC Current Gain

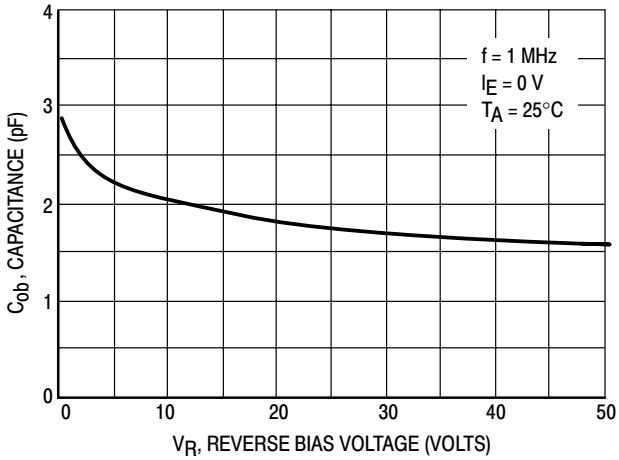


Figure 4. Output Capacitance

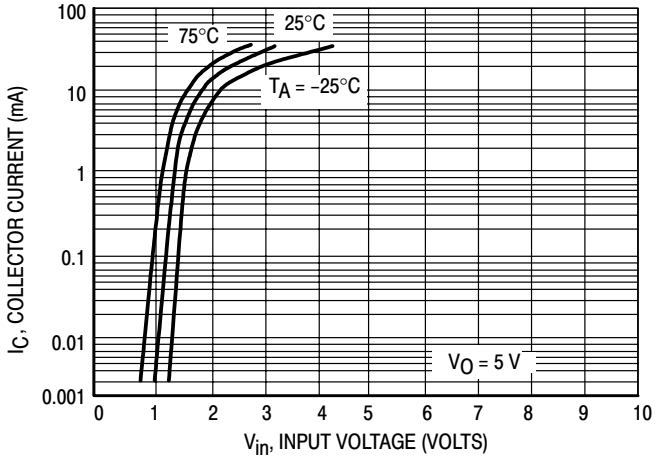


Figure 5. Output Current versus Input Voltage

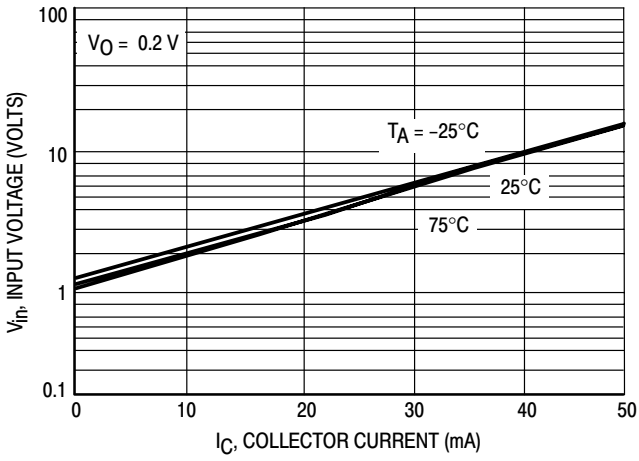


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2112LT1G

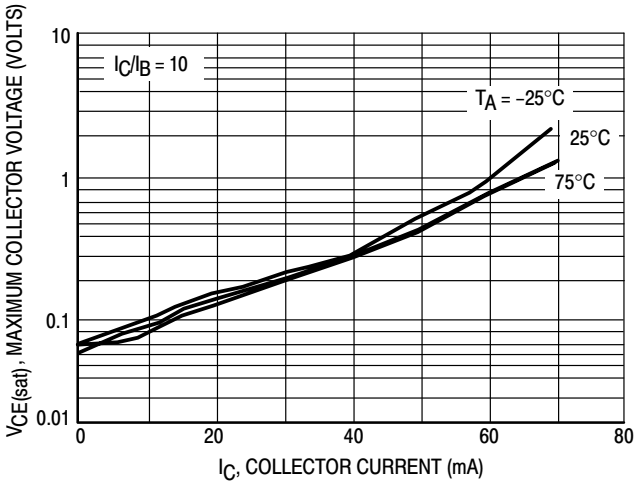


Figure 7. $V_{CE(sat)}$ versus I_C

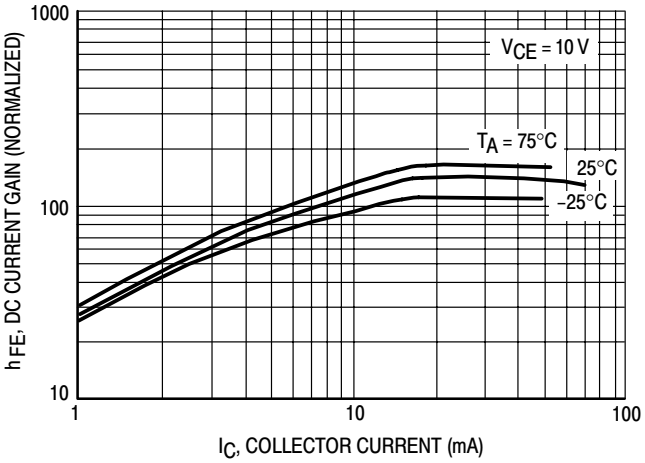


Figure 8. DC Current Gain

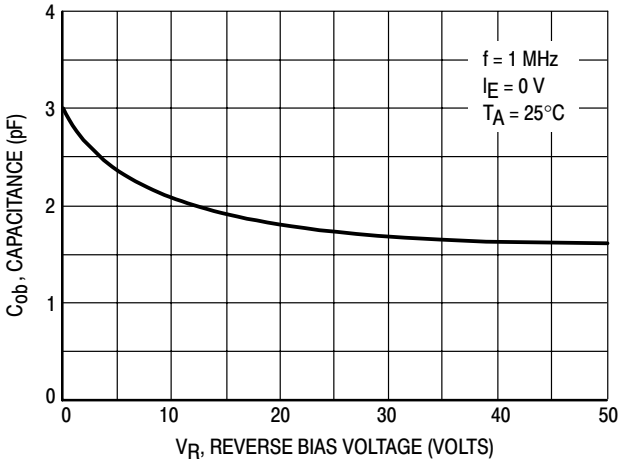


Figure 9. Output Capacitance

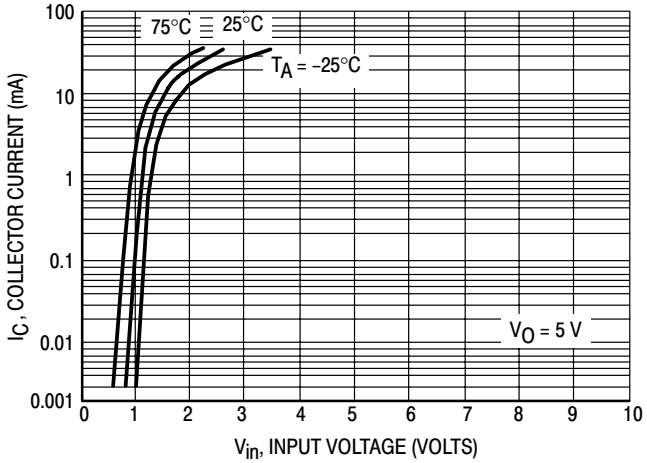


Figure 10. Output Current versus Input Voltage

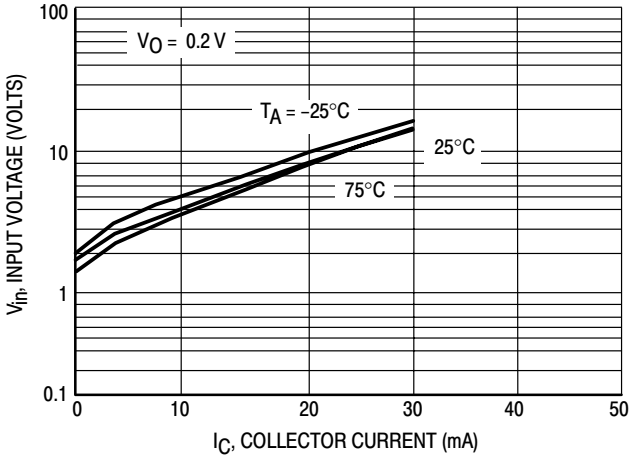


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2113LT1G

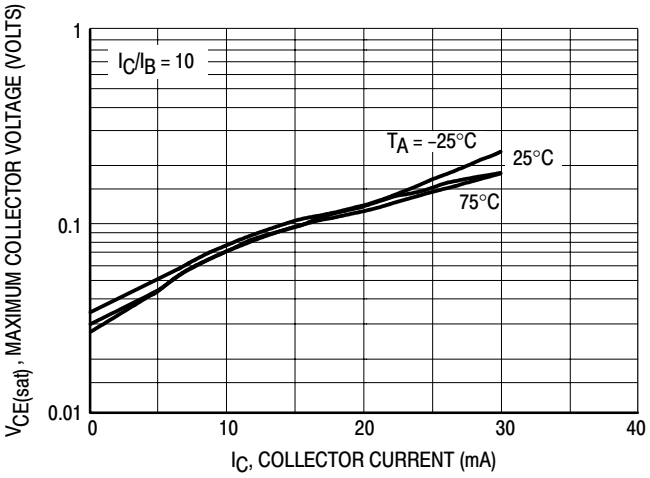


Figure 12. $V_{CE(sat)}$ versus I_C

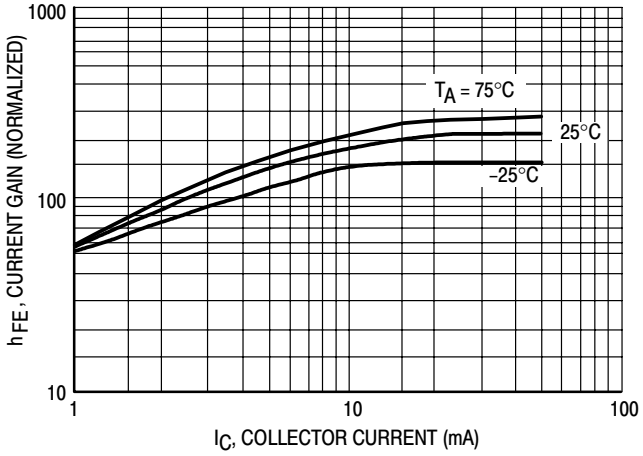


Figure 13. DC Current Gain

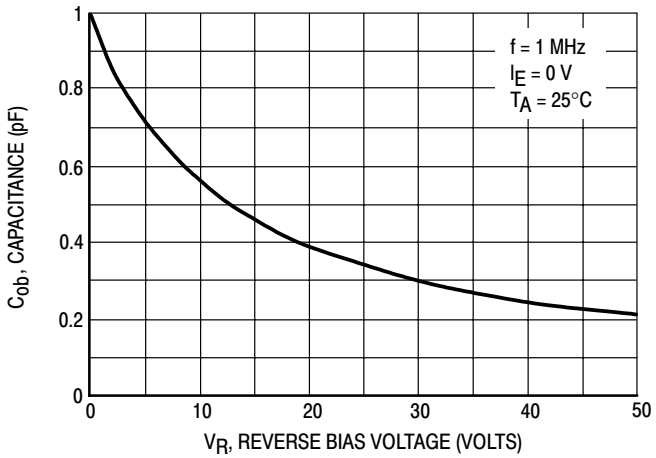


Figure 14. Output Capacitance

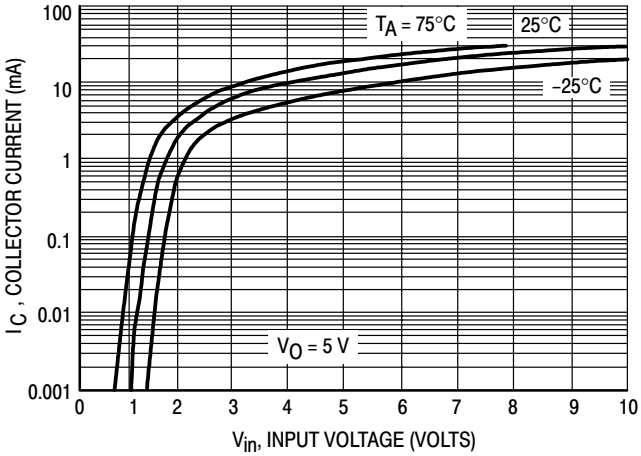


Figure 15. Output Current versus Input Voltage

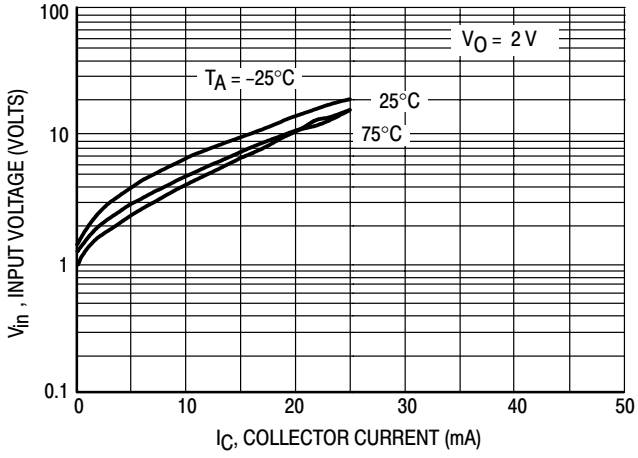


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2114LT1G

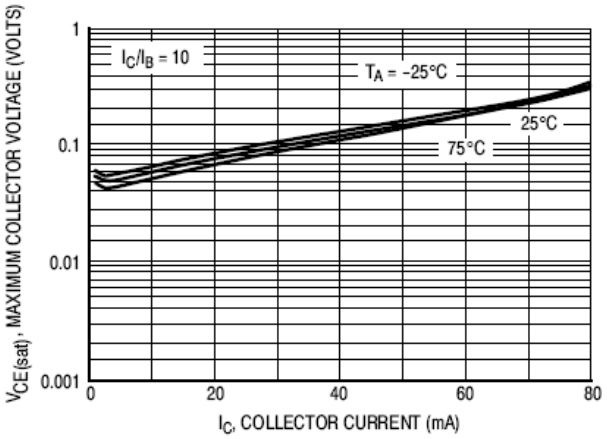


Figure 17. $V_{CE(sat)}$ versus I_C

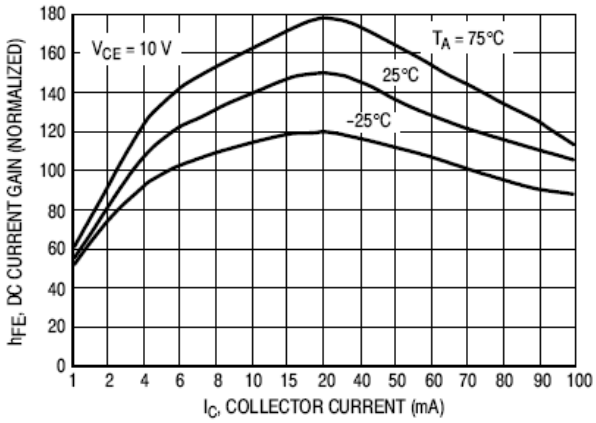


Figure 18. DC Current Gain

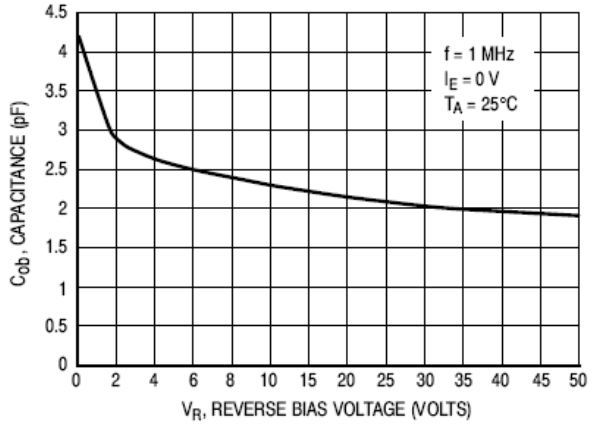


Figure 19. Output Capacitance

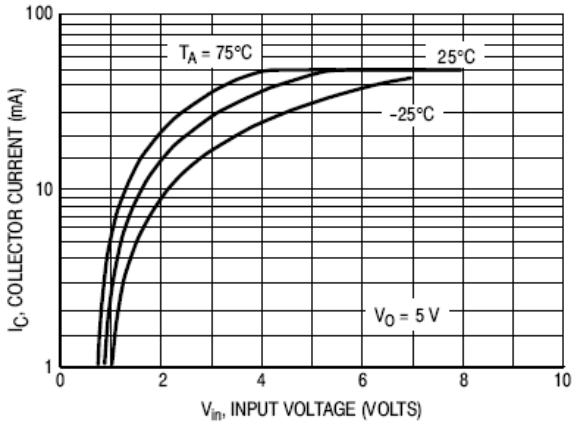


Figure 20. Output Current versus Input Voltage

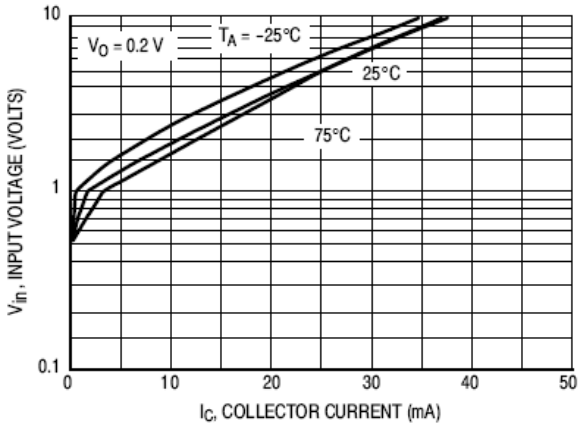


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS

S-MUN2115LT1G

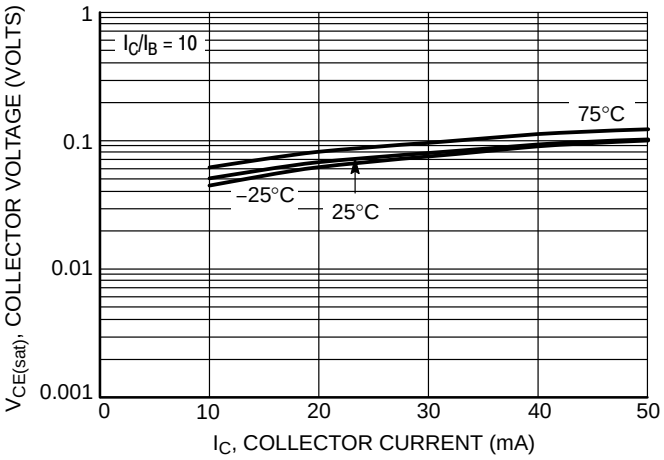


Figure 22. $V_{CE(sat)}$ versus I_C

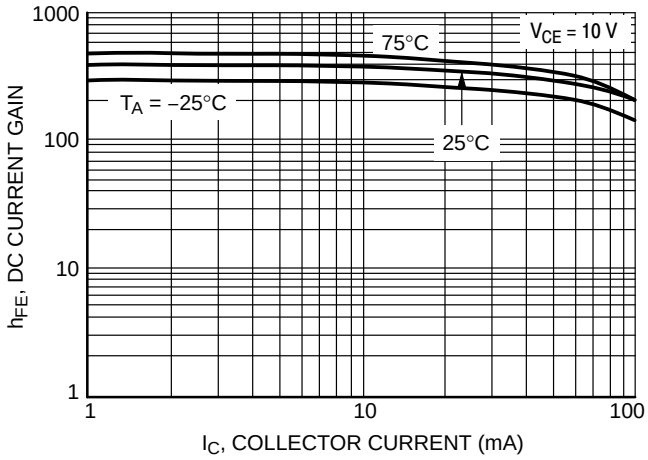


Figure 23. DC Current Gain

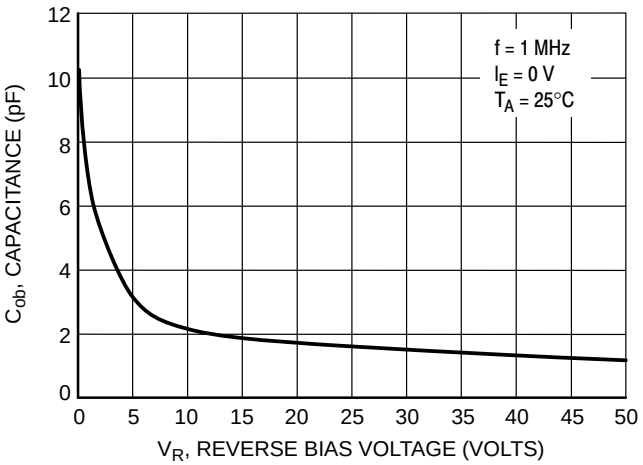


Figure 24. Output Capacitance

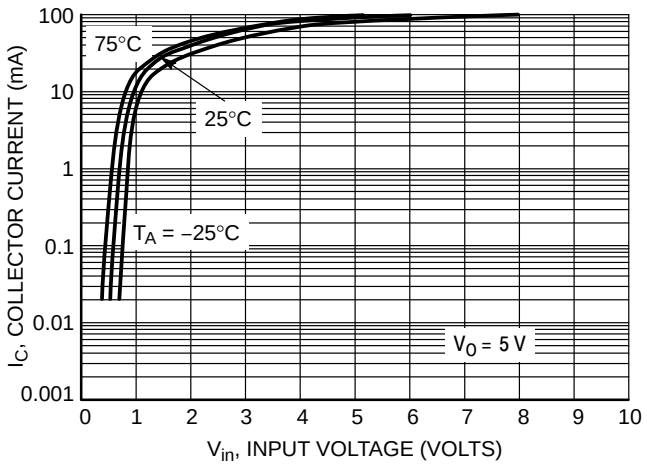


Figure 25. Output Current versus Input Voltage

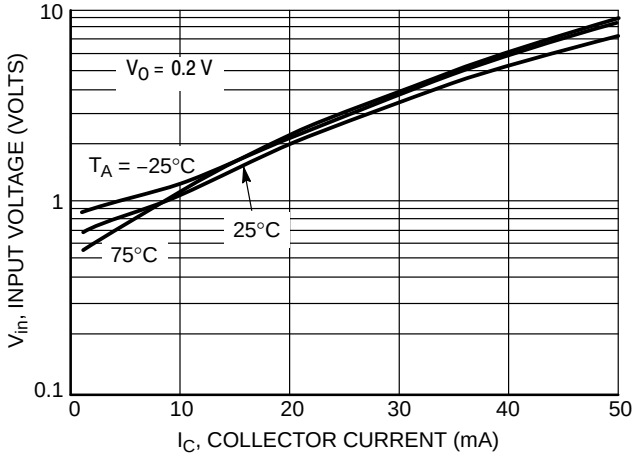


Figure 26. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2116LT1G

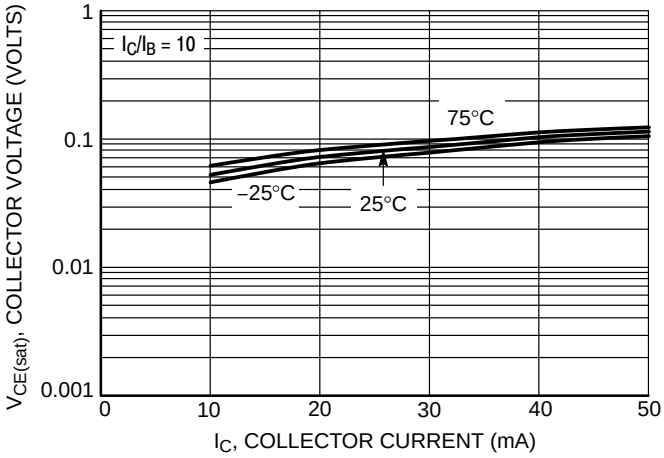


Figure 27. $V_{CE(sat)}$ versus I_C

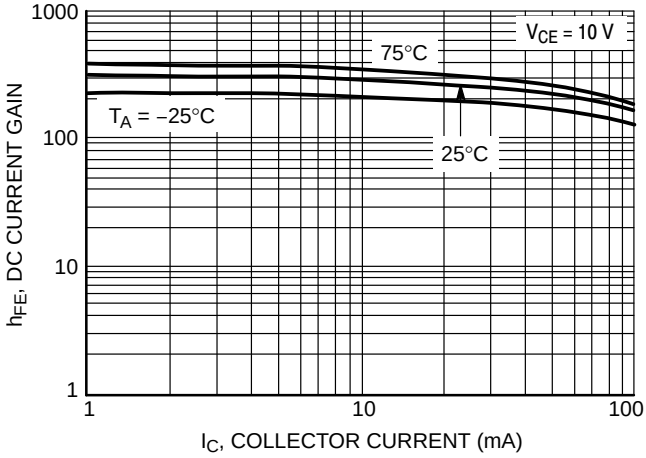


Figure 28. DC Current Gain

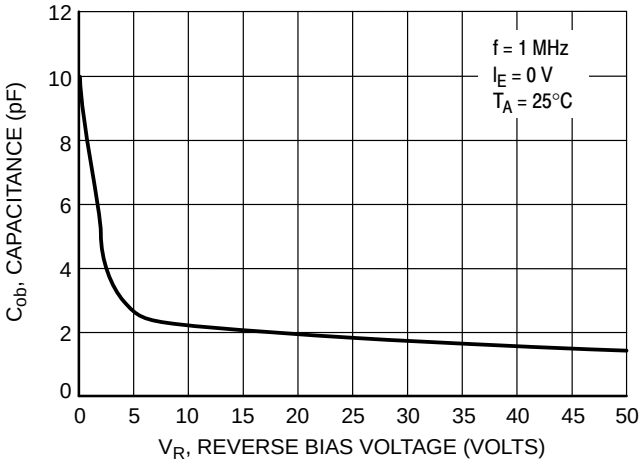


Figure 29. Output Capacitance

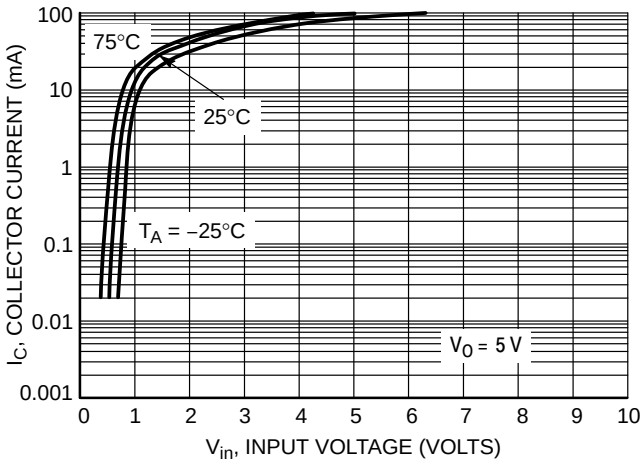


Figure 30. Output Current versus Input Voltage

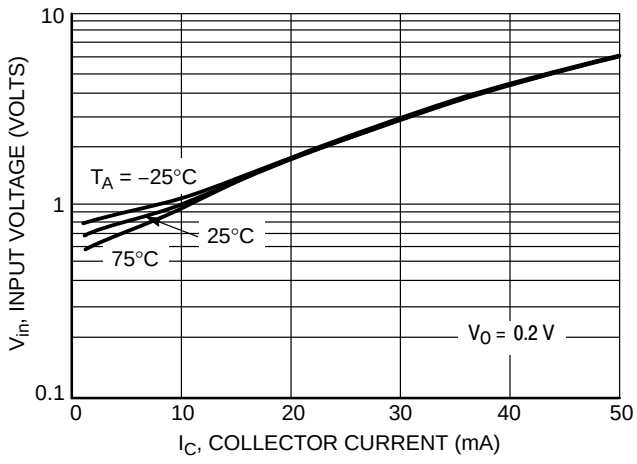


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2131LT1G

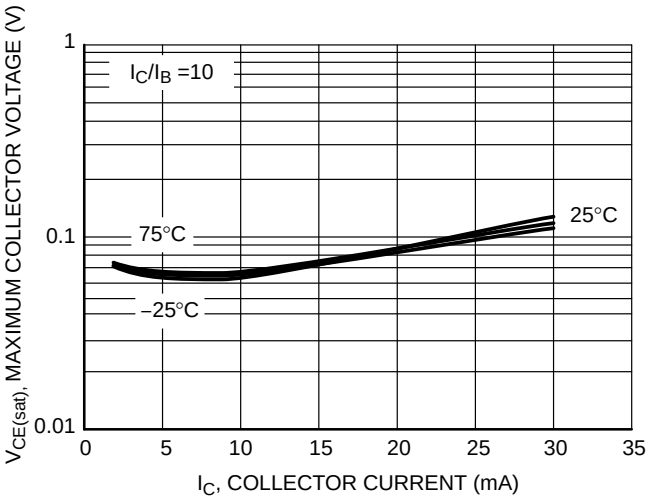


Figure 32. $V_{CE(sat)}$ vs. I_C

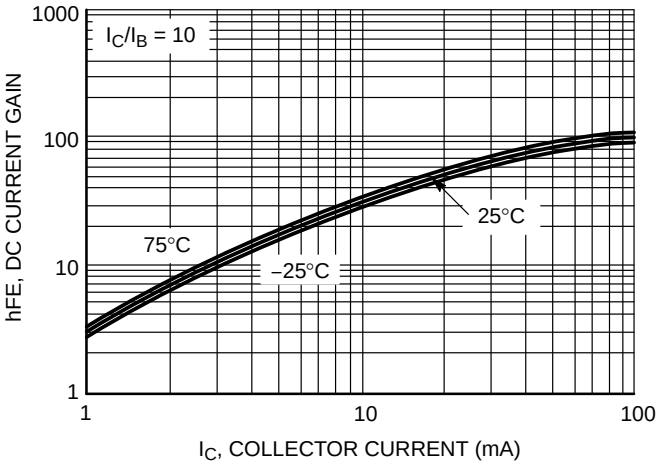


Figure 33. DC Current Gain

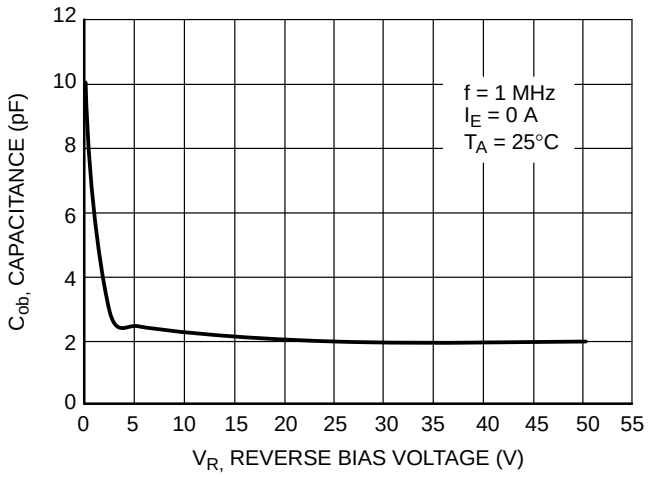


Figure 34. Output Capacitance

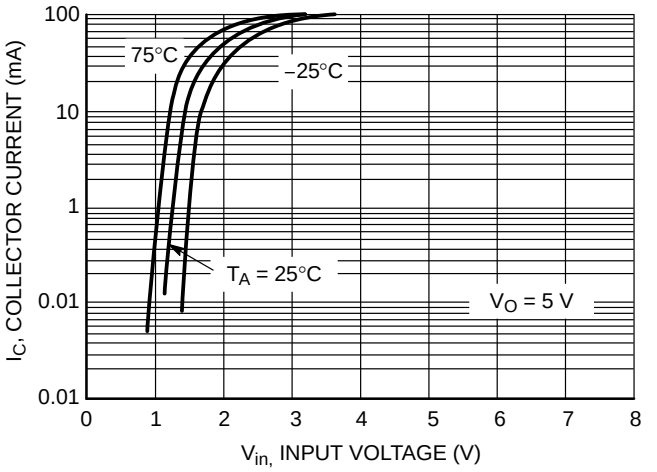


Figure 35. Output Current vs. Input Voltage

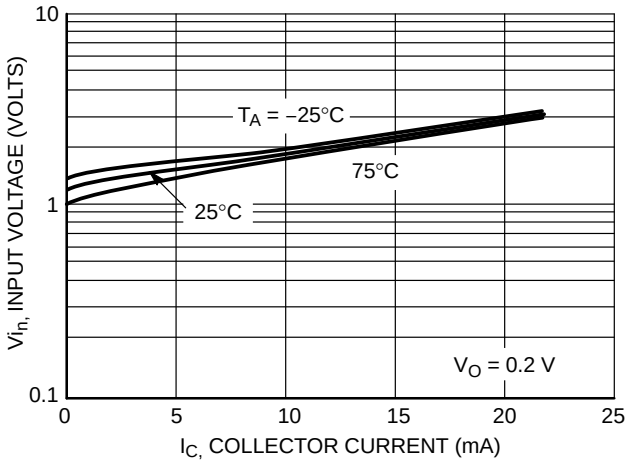


Figure 36. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2132LT1G

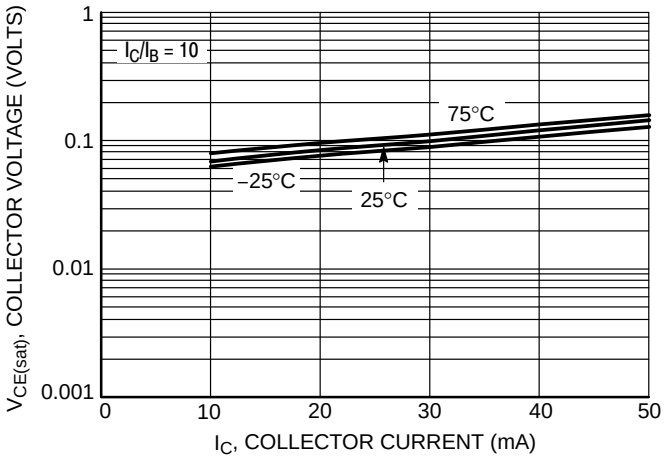


Figure 37. $V_{CE(sat)}$ versus I_C

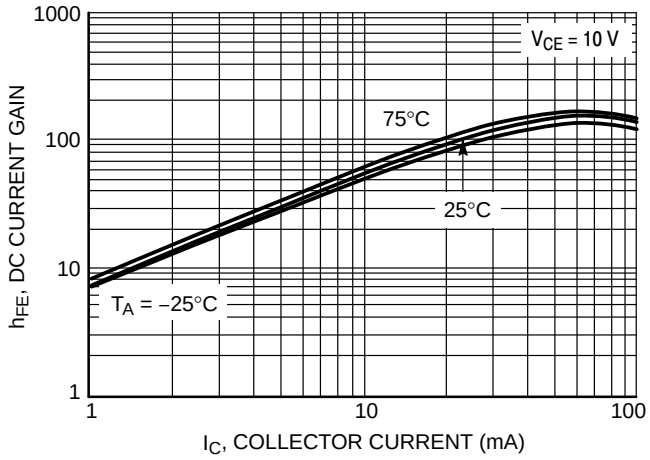


Figure 38. DC Current Gain

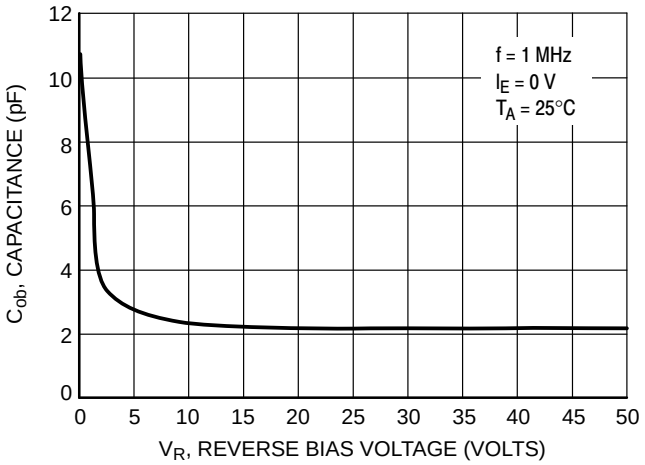


Figure 39. Output Capacitance

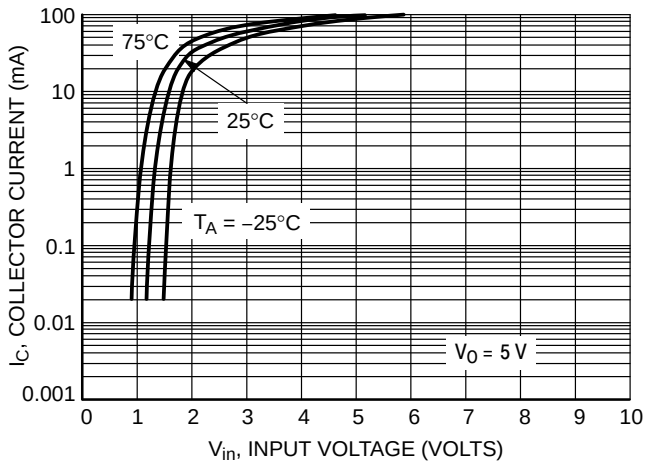


Figure 40. Output Current versus Input Voltage

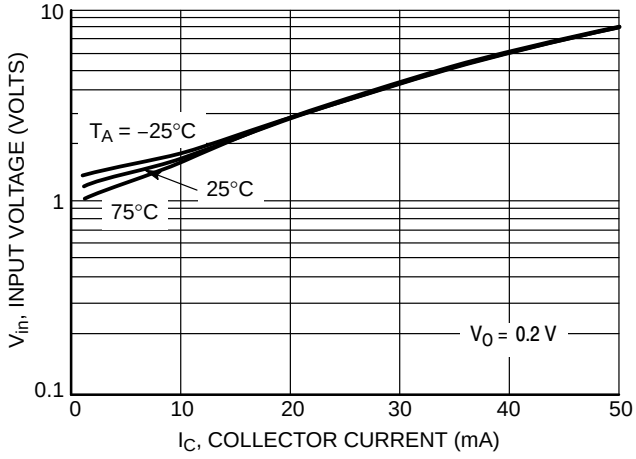


Figure 41. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2133LT1G

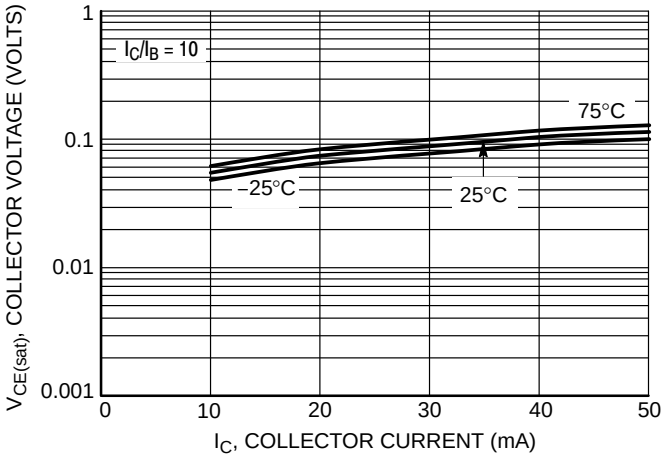


Figure 42. $V_{CE(sat)}$ versus I_C

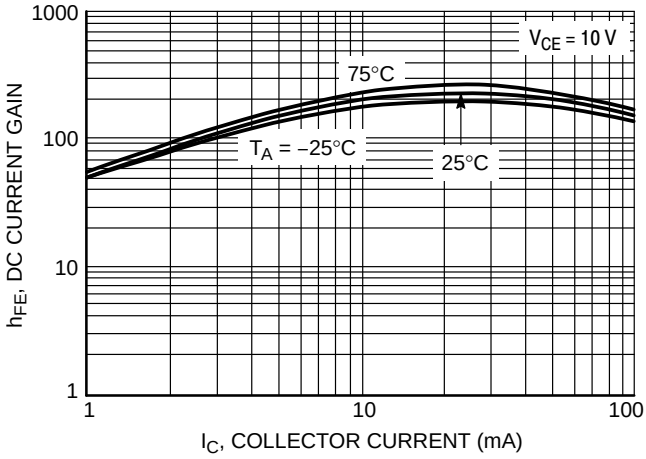


Figure 43. DC Current Gain

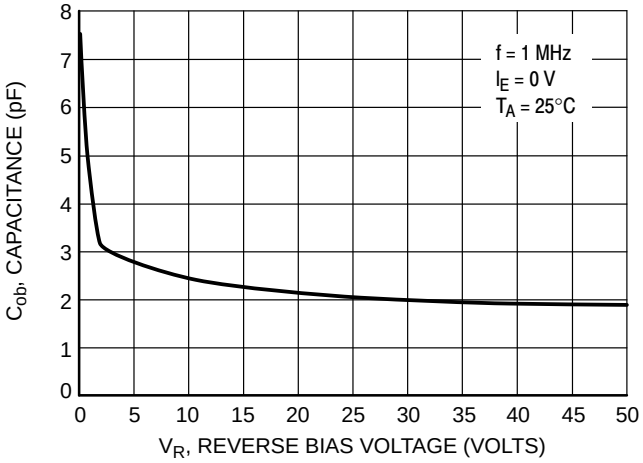


Figure 44. Output Capacitance

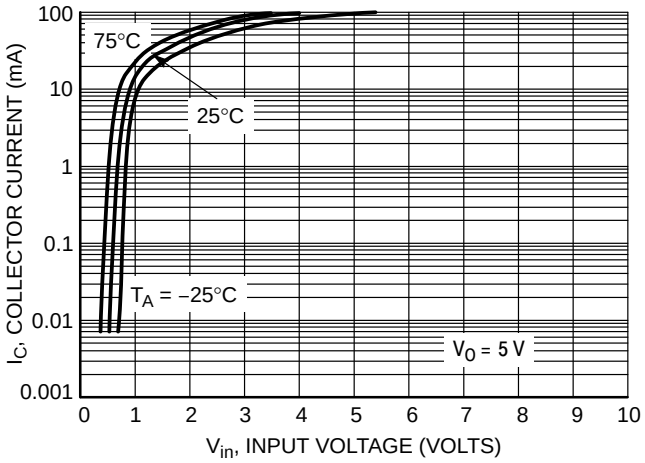


Figure 45. Output Current versus Input Voltage

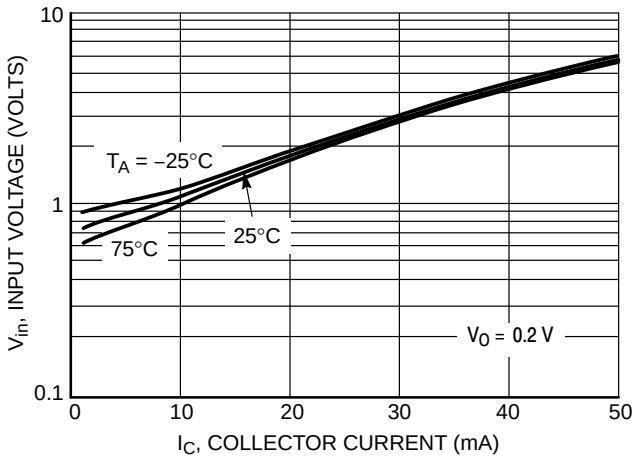


Figure 46. Input Voltage versus Output Current

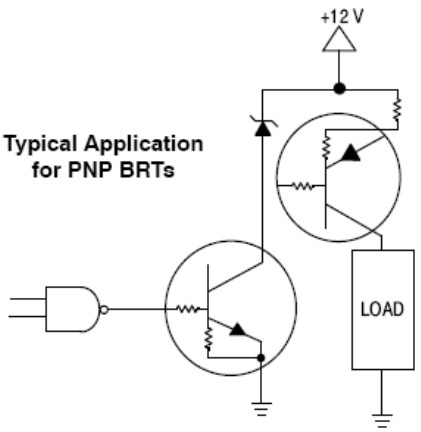


Figure 47. Inexpensive, Unregulated Current Source

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2136LT1G

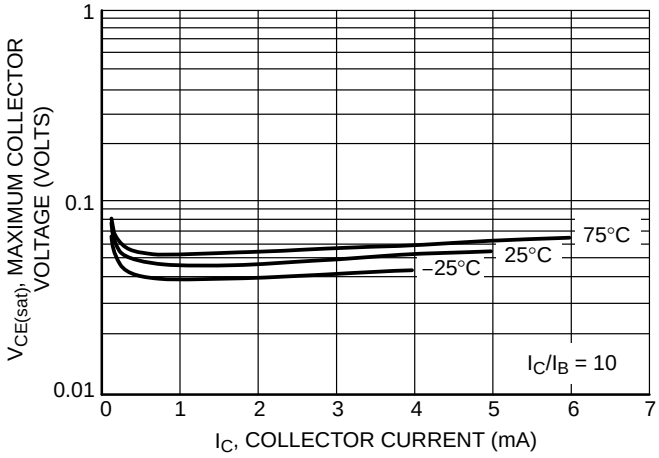


Figure 48. Maximum Collector Voltage vs. Collector Current

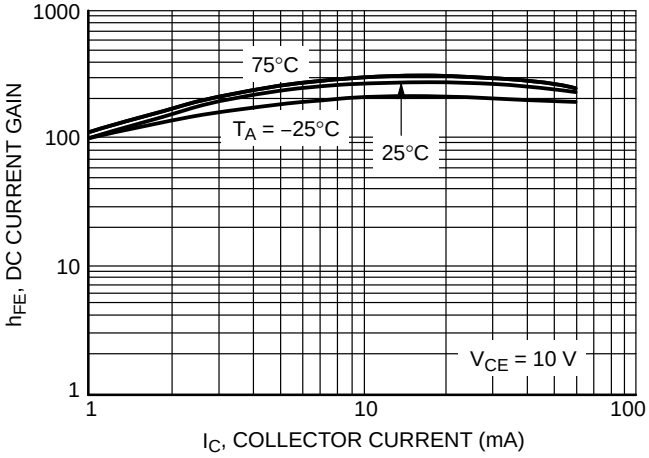


Figure 49. DC Current Gain

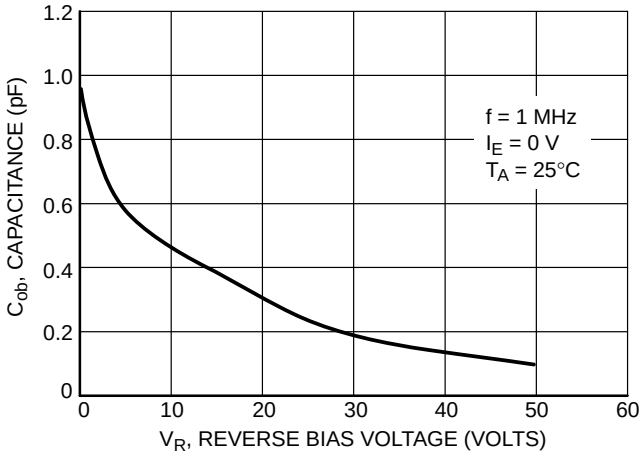


Figure 50. Output Capacitance

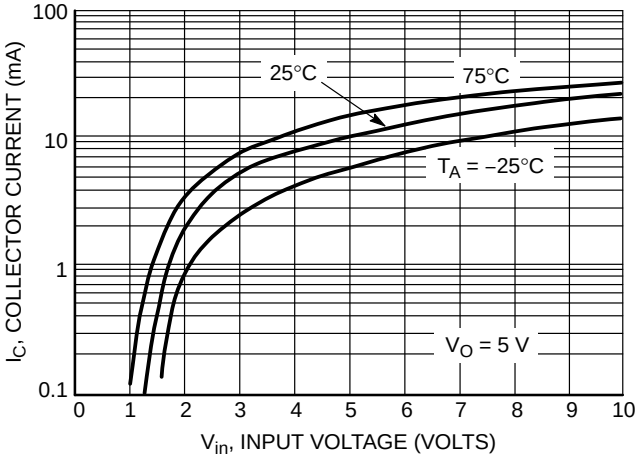


Figure 51. Output Current vs. Input Voltage

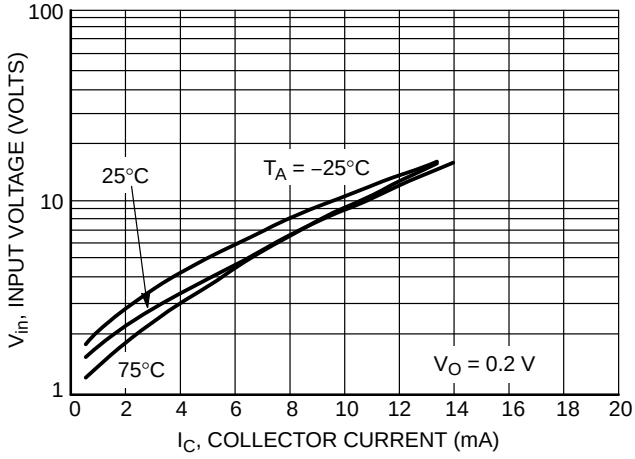


Figure 52. Input Voltage vs. Output Current

TYPICAL ELECTRICAL CHARACTERISTICS
S-MUN2137LT1G

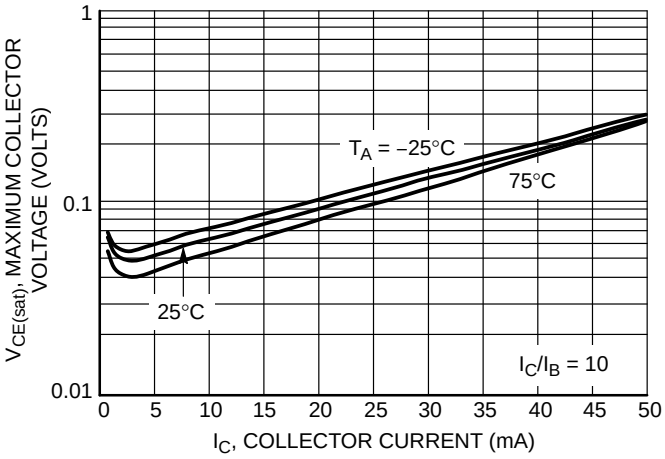


Figure 53. Maximum Collector Voltage vs. Collector Current

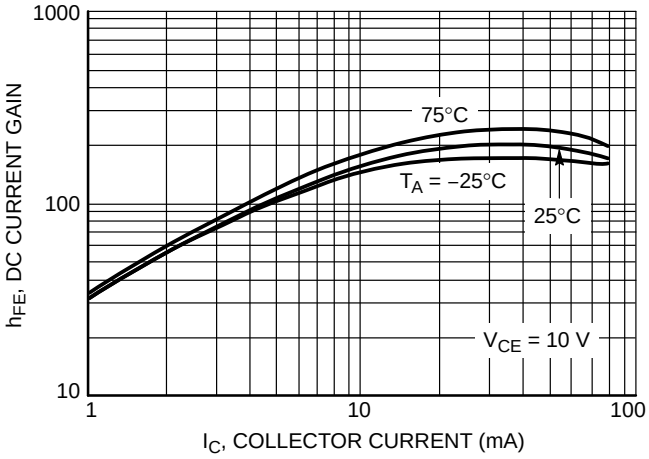


Figure 54. DC Current Gain

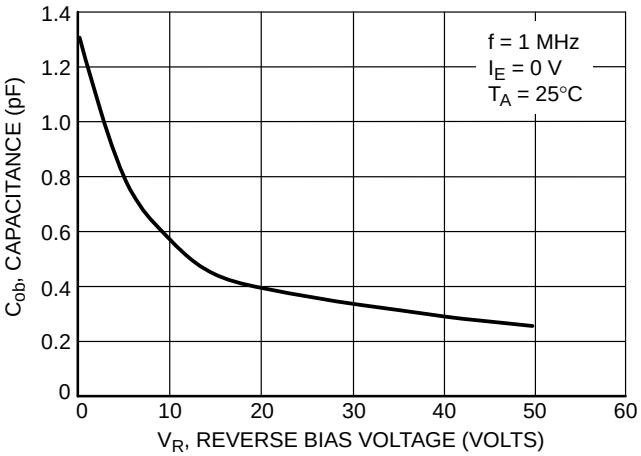


Figure 55. Output Capacitance

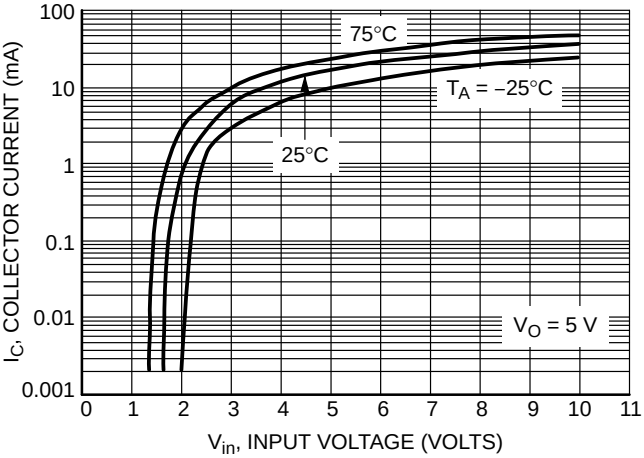


Figure 56. Output Current vs. Input Voltage

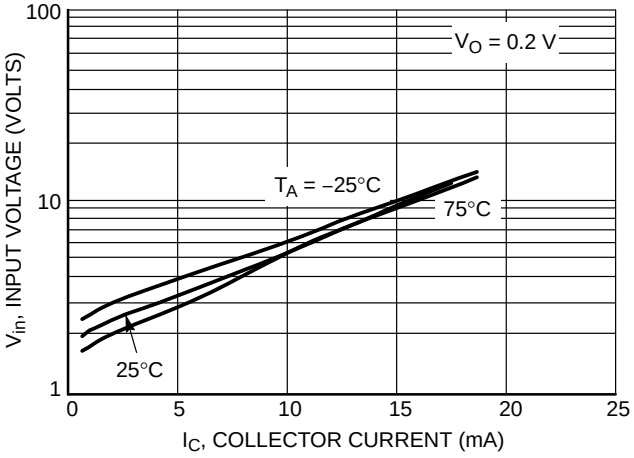
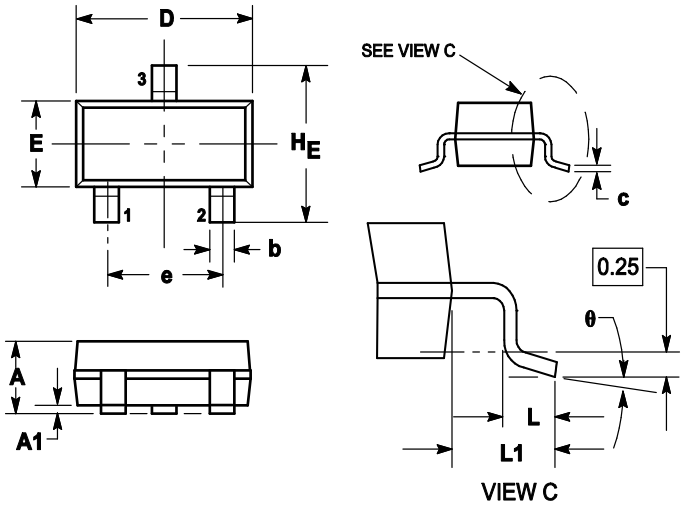


Figure 57. Input Voltage vs. Output Current

Bias Resistor Transistor PNP Silicon
S-MUN2110LT1G Series

OUTLINE AND DIMENSIONS



Notes:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1	1.11	0.035	0.04	0.044
A1	0.01	0.06	0.1	0.001	0.002	0.004
b	0.37	0.44	0.5	0.015	0.018	0.02
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.9	3.04	0.11	0.114	0.12
E	1.20	1.3	1.4	0.047	0.051	0.055
e	1.78	1.9	2.04	0.07	0.075	0.081
L	0.10	0.2	0.3	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.4	2.64	0.083	0.094	0.104
θ	0°	---	10°	0°	---	10°

SOLDERING FOOTPRINT